# A-NSE - airships and aerostats

Peter Lobner, updated 19 June 2023

# 1. Introduction

Aero-Nautic Services & Engineering (A-NSE) was founded in 2011 and is based in Le Castellet, France. The firm offers customers a wide range of airborne surveillance systems based on unmanned tethered aerostats (moored balloons) and free-flying manned



airships. The airships are designed to carry out surveillance missions effectively, at lower operating cost and over considerably longer range

than fixed-wing aircraft and helicopters. The aerostats and airships can be configured to conduct a range of missions with equipment such as a radar, an electro-optical / infrared (EO/IR) system, an automatic identification system (AIS), or electronic warfare devices.

The company's website is here: <u>http://www.a-nse.com</u>



2. Variable volume, variable buoyancy lifting gas envelope

Several of A-NSE's larger aerostats and airships have a characteristic variable volume, and hence, variable buoyancy, three-lobe gas envelope, similar in design to the Voliris 901-series airships.

Computational fluid dynamics (CFD) model of a tri-lobe hull. Source: A-NSE

This unusual feature allows the envelope's volume and shape to be altered in flight to adapt to the flying conditions. For example, one shape is better suited to hovering (i.e., high buoyancy), whereas other shapes are better suited for different flight modes where there will be varying degrees of aerodynamic lift (i.e., takeoff, cruise, approach and landing). The system can change envelope volume by 14% and aerostatic lift by 150%.

This system also offers the possibility of reducing the height of the airship's envelope, and therefore the required hangar height, by 30%. This could be important because few airports have hangars that are able to accommodate aircraft over 12 meters (39.4 m) tall.



Low-profile gas envelope fits into a conventional hangar. Source: A-NSE

The very short 2012 video, "A-NSE Enveloppe de dirigeable à volume et géométrie variables" (0:13 minutes), at the following link, illustrates the variable volume process employed by A-NSE, with narration in French:

https://www.youtube.com/watch?v=rzLB2-va5F0&feature=emb\_logo



One cycle for increasing and decreasing envelope volume. Source: Screenshots from A-NSE video

#### 3. Airships: A-N400, A-N800, A-N1800 and A-N20 000

#### <u>A-N400</u>



A-N400 in flight. Sources: Wikipedia (above), A-NSE (right).

The single-seat, single-lobe A-N400 is a manned, non-rigid airship designed for VFR day & night maritime surveillance missions. Radar range is 100 km (62 miles) and EO/IR range is 30 km (18 miles). The airship has an extendable sea landing system.



Parameter	A-N400
Length	25 m (82 ft)
Diameter, max.	5.5 m (18 ft)
Envelope volume	400 m <sup>3</sup> (14,126 ft <sup>3</sup> )
Weight, empty	240 kg (529 lb)
Weight, max. takeoff	400 kg (882 lb)
Useful load	160 kg (353 lb), including single crew & fuel
Propulsion	2 @ 18 hp (13.4 kW) each, can vector 90°
	up / down from neutral cruise position
Max. wind at takeoff	45 kph (28 mph)
Speed	0 - 85 kph (0 to 52.8 mph),
	cruise @ 65 kph (40 mph)
Rate-of-climb	5 m/sec (16.4 ft/sec)
Altitude	30 to 914 m (100 to 3,000 ft)
Action range	390 km (242 miles)
Endurance	Max. 10 hours; @ max. speed: 6 hours



A-N400 in flight. Note the two thrust-vectoring engines cantilevered from the single-seat gondola and the sea landing system retracted and stowed behind. Source: A-NSE



A-N400 without the sea landing system installed. Source, three images: screenshots from video (2018)



Engine in cruise position (left) and vectored 90° down (right).



Lat: N 49=19.210 Lan: E 0=20.003\* PRENCH CUSTOMS 29-0ct-2009 13:22:24L Electro-optical surveillance system can provide wide area and closeup views. Source, four images: screenshots from video (2018)

#### <u>A-N800</u>

The single-lobe A-N800 is a manned, non-rigid airship designed for operating in IFR (instrument flight rules) conditions. It has twice the volume and lifting capacity of the A-N400.



The A-N800 tri-lobe envelope. Source: A-NSE

Parameter	A-N800
Length	31 m (102 ft)
Diameter, max.	7 m (23 ft)
Envelope volume	800 m <sup>3</sup> (28,252 ft <sup>3</sup> )
Weight, empty	450 kg (992 lb)
Weight, max. takeoff	800 kg (1,764 lb)
Useful load	350 kg (772 lb), including crew & fuel
Propulsion	2 @ 60 hp (44.7 kW) each, can vector 90°
	up / down from neutral cruise position
Max. wind at takeoff	60 kph (37 mph)
Speed	0 - 105 kph (0 - 65 mph),
	cruise @ 85 kph (52.8 mph)
Rate-of-climb	8 m/s (26.6 ft/sec)
Altitude	30 to 3,048 m (100 to 10,000 ft)
Action range	850 km (528 miles)
Endurance	Max: 18 hours;
	@ max. speed: 10 hours

#### A-N1800 Hydroblimp

The Hydroblimp has an optionally-manned, three-lobe, non-rigid airship designed for operating in IFR conditions. Three floats are adapted for landing on any kind of water surface. An annular external structure around the envelope provides reinforcement and distributes loads from wind and waves.



Rendering of the A-N1800 airship with tri-lobe envelope, X-tail and floats for water landings. Source: A-NSE

Parameter	A-N1800
Length	38 m (124.6 ft)
Diameter, max.	10 m (32.8 ft)
Envelope volume	1,800 m <sup>3</sup> (63,566 ft <sup>3</sup> )
Weight, empty	1,060 kg (3,527 lb)
Weight, max. takeoff	1,800 kg (3,968 lb)
Useful load	740 kg (1,631 lb), including crew & fuel
Propulsion	2 x flank-mounted rated @ 220 hp (164 kW)
	each + 1 stern-mounted rated @ 40 hp (29.8
	kW). The flank motors can vector 90°
	up / down from neutral cruise position.
Max. wind at takeoff	80 kph (50 mph)
Speed	0 - 150 kph (0 - 93 mph),
	cruise @ 130 kph (81 mph)
Rate-of-climb	8 m/s (26.6 ft/sec)
Altitude	30 m to 3,048 m (100 to 10,000 ft)
Action range	1,550 km (63 miles)
Endurance	Max: 20 hours;
	@ max. speed: 12 hours

## <u>A-N20 000</u>

Under a "New Industrial France" government industrialization policy comprised of nine strategic industrial focus areas, including "transport of tomorrow," and confirmed in 2015, A-NSE prepared plans for a manned, multi-mission, medium lift airship known as the A-N20 000. This three-lobe airship was designed to carry payloads of 8 to 12 metric tons (8.8 to 13.2 tons) and operate without ground infrastructure. It was targeted for the following markets:

- Point-to-point transport of large loads:
  - Transport for building and civil engineering works
  - Transport large antennas
  - Mining material transport
- ISR (Intelligence, Surveillance, Reconnaissance)

One of the original goals of the French industrialization policy was to "commission a certified airship dedicated to the point-to-point transport of heavy loads," by 2019 /2020.



Rendering of the A-N 20 000 medium-lift airship concept with tri-lobe envelope. Source: Aerall.org



Three renderings of the A-N 20 000 medium-lift airship in various roles: Point-to-point transport (top & middle) & ISR (bottom). Source: SAFE Cluster

4. Tethered aerostats: T-C60, T-C60L, T-C350 and T-C1400

# <u>T-C60</u>



T-C60 on its mooring platform; deployable in about 8 minutes.



T-C60 viewed from below. Source, both photos: A-NSE

Parameter	T-C60
Туре	Tethered balloon
Diameter	from 4 to 8 m (13 to 26.2 ft)
Envelope volume	from 30 to 120 m <sup>3</sup> (1,059 to 4,238 ft <sup>3</sup> )
Altitude	up to 305 m (1,000 ft)
Max. wind	80 kph (50 mph)
Payload	from 5 to 50 kg (11 to 110 lb)
Equipment	EO/IR, communication system
Endurance	10 days

## <u>T-C60L</u>

The T-C60L is a larger, more robust version of the original T-C60, capable of carrying a somewhat heavier payload to a higher altitude, while retaining the ability to operate from a small mooring platform.



T-C60L flying on its tether. Source, both photos: A-NSE



Parameter	T-C60L
Туре	Tethered balloon
Diameter	from 12 to 16 m (39.4 to 52.5 ft)
Envelope volume	from 150 to 300 m <sup>3</sup> (5,297 to 10,594 ft <sup>3</sup> )
Altitude	up to 600 m (about 1,969 ft)
Max. wind	90 kph (56 mph)
Payload	up 60 kg (132.3 lb)
Equipment	EO/IR, radar, electronic warfare,
	communication system
Endurance	20 days

In 2017, French firefighters from the city of Marseille deployed a T-C60L aerostat equipped with an infrared camera turret that provided 360° coverage and could automatically detect a fire within minutes of it starting at a range of about 10 km (6.2 miles). The aerostat system alerted nearby firefighters and provided the GPS coordinates of the blaze. The aerostat operated at an altitude of 600 m (1,969 ft) and provided persistent fire surveillance for 10 days at a time.



A-NSE T-C60L launching from its compact mooring station for fire watch duty near Marseille, France. Source: Screenshot from EuroNews video (2017)



A-NSE T-C60L at operating altitude above the wooded hills near the city of Marseille, in the background. Source: A-NSE

## T-C350 (original model)

This tri-lobe aerostat is capable of carrying a 200 kg (441 lb) payload to altitudes up to 914 m (3,000 ft) on missions lasting up to 40 days.



T-C350 aerostat moored (above) and viewed from below, highlighting the three-lobe hull design (below). Source, both photos: A-NSE



Parameter	T-C350 (original model)
Туре	Tethered three-lobe balloon
Length	from 25 to 35 m (82 to 115 ft)
Envelope volume	from 150 to 900 m <sup>3</sup> (5,297 to 31,783 ft <sup>3</sup> )
Altitude	up to 914 m (3,000 ft)
Max. wind	110 kph (68.4 mph)
Payload	up to 200 kg (441 lb)
Equipment	EO/IR, radar, electronic warfare, communication system
Endurance	40 days



T-C350 mooring station. Source: Screenshot from A-NSE video (2016)

In 2016, Mer et Marine reported, "A-NSE has also developed a captive balloon concept for the Total Group. Equipped with a radar and an optronic surveillance system, this T-C350 balloon will be deployed by a barge anchored off the coast of West Africa to protect one of the customer's offshore oil fields."



T-C350 offshore barge base concept developed for Total Group. Source: A-NSE via Mer et Marine (2016)

Under a program known as "Operation Poseidon," the European Border and Coast Guard Agency (Frontex) has supported the Greek Coast Guard since 2015 in handling the unprecedented number of migrants arriving on Greek islands in the Aegean Sea. Starting on 30 July 2019, Frontex tested a tethered aerostat for the first time to monitor the EU's southern border off the island of Samos. This fourweek pilot project was conducted by the German firm <u>in-innovative</u> <u>navigation GmbH</u> using a 35-meter (115 ft) long A-NSE T-C350 aerostat equipped with a thermal (infrared) camera, radar and an Automatic identification System. During this pilot project, the T-C350 aerostat monitored irregular border crossings at the Mycale Strait, which is only two kilometers (1.2 miles) wide at its narrowest point.



A-NSE T-C350 aerostat supporting Operation Poseidon. Source: Frontex



As part of this pilot project, the aerostat's real-time monitoring capabilities were compared with that of a mobile groundbased sensor station with equivalent equipment on loan from the Portuguese Guarda Nacional Republicana (GNR) Marine Surveillance System.

Ground-based sensor station. Source: NavalNews.

Through this pilot program, the Hellenic Coast Guard became the first European Union Coast Guard service to use a tethered aerostat for policing a sea area. The aerostat system successfully demonstrated its ability to detect illegal immigration activity on the target area. The Frontex budget for this pilot program was € 482,000.



A-NSE T-C350 aerostat supporting Operation Poseidon pilot project in Greece. Source, both photos: Frontex



A follow-on Frontex-funded Poseidon aerostat project was conducted in Greece using CNIM Air Space (acquired by Hemeria in 2022) Eagle Owl tethered aerostats.

#### T-C350 (updated model)

The updated T-C350 model discontinues use of the tri-lobe gas envelope of its predecessor (with the same model designation) in favor of a conventional blimp-style gas envelope with a single ballonet. The updated model is capable of carrying a heavier payload (up to 300 kg / 661 lb) to a higher altitude (up to 1,372 m / 4,500 ft).



T-C350 (updated model) deployed above its mooring cradle and hangar. Source: A-NSE

Parameter	T-C350 (updated model)
Туре	Tethered balloon
Length	from 20 to 30 m (65.6 to 98.4 ft)
Envelope volume	from 600 to 1,500 m <sup>3</sup> (21,189 to 52,972 ft <sup>3</sup> )
Altitude	up to 1,372 m (4,500 ft)
Max. wind	110 kph (68.4 mph)
Payload	up to 300 kg (661 lb)
Equipment	EO/IR, radar, electronic warfare, communication system
Endurance	40 days



T-C350 (updated model) deployed on its tether. Note the shadow of the single air ballonet inside the gas envelope. Source: A-NSE

In 2021, the German Bundeswehr used a T-C350 (updated model) equipped with modular sensors to provide persistent surveillance around its military base at Tillia in Niger, Africa.

#### <u>T-C1400</u>

This is A-NSE's largest tri-lobe aerostat. It is capable of carrying a 750 kg (1,653 lb) payload to altitudes up to 2,743 m (9,000 ft) on missions lasting up to 60 days.



Three-lobe T-C1400 on its mooring cradle (above) and flying tethered (below). Source, both photos: A-NSE



Parameter	T-C1400
Туре	Tethered three-lobe balloon
Length	from 38 to 60 m (124.6 to 196.9 ft)
Envelope volume	from 1,000 to 5,000 m <sup>3</sup> (35,314 to 176,573 ft <sup>3</sup> )
Altitude	up to 2,743 m (9,000 ft)
Max. wind	130 kph (80.8 mph)
Payload	up to 750 kg (1,653 lb)
Equipment	EO/IR, radar, electronic warfare, communication system
Endurance	60 days

#### 5. For more information

- "A-NSE," Wikipedia (in French): <u>https://fr.wikipedia.org/wiki/A-NSE</u>
- "SAFE cluster build up the industrial airship sector," circa 2015: <u>http://www.safecluster.com/wp-content/uploads/2016/03/GB-version.pdf</u>
- Vincent Groizeleau, "A-NSE, the French specialist in surveillance aerostats," Mer et Marine, 22 November 2016: <u>https://www.meretmarine.com/fr/defense/a-nse-french-specialist-surveillance-aerostats</u>
- "Firefighters in France are using a balloon to spot forest fires as soon as they start," (with embedded video), EuroNews, 2 August 2021: <u>https://www.euronews.com/next/2021/08/02/firefighters-in-</u>

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- Xavier Vavasseur, "Hellenic Coast Guard Testing Tethered Aerostat For FRONTEX Mission," Naval News, 29 July 2019: <u>https://www.navalnews.com/naval-news/2019/07/helleniccoast-guard-testing-tethered-aerostat-for-frontex-mission/</u>
- "Greece Puts Tethered Aerostat in One-Month Trial Operation for Guarding Schengen Coast," EU/Schengen, 30 July 2019: <u>https://www.schengenvisainfo.com/news/greece-puts-tethered-aerostat-in-one-month-trial-operation-for-guarding-schengencoast/</u>
- Tasos Kokkinidis, "Greece Begins Monitoring Flow of Migrants With Blimp," Greek Reporter, 30 July 2019:

https://greekreporter.com/2019/07/30/greece-beginsmonitoring-flow-of-migrants-with-blimp/

# <u>Videos</u>

- "A-NSE Presentation," (1:40 min), posted by A-NSE. 16 September 2016: https://www.youtube.com/watch?v=MvxLtFJbX5g&t=22s
- "T-C350 Presentation," (2:16 min), posted by A-NSE, 19 September 2016: https://www.youtube.com/watch?v=9Qj6QejXDEA&t=10s
- "T C60 French Navy," (0:51 min), posted by A-NSE, 21 November 2016: <u>https://www.youtube.com/watch?v=7-K2ld-N3SQ</u>
- "Aerial view of Paris from a T-C60," (2:55 min), posted by A-NSE, 6 January 2017: https://www.youtube.com/watch?v=MM4KPLL48eA
- "Le retour des dirigeables," (In French), (7:59 min, A-NSE 400 & Zeppelin NT), FUTUREMAG video posted by Le blob, l'extramédia, 21 March 2018: https://www.youtube.com/watch?v=TSs5d333LyE

# Other Modern Airships articles

- Modern Airships Part 1: <u>https://lynceans.org/all-posts/modern-airships-part-1/</u>
  - Voliris airships
- Modern Airships Part 2: <u>https://lynceans.org/all-posts/modern-airships-part-2/</u>
  - Airstar Aerospace airships, tethered aerostats & stratospheric balloons
  - Hemeria (formerly CNIM Air Space, and before that, Airstar Aerospace) tethered aerostats, drone airships & stratospheric balloons
- Modern Airships Part 3: <u>https://lynceans.org/all-posts/modern-airships-part-3/</u>